

# **FIRE IN THE FOREST: GOOD AND BAD**

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The mention of fire in the forest usually creates visions of devastating walls of flames, clouds of billowing smoke, smoldering tree trunks, and burned bodies of animals trapped in the flames. Although this concept may sometimes be true of wildfires, it is certainly not true of all fires, especially prescribed fire.

Historically, fire—natural, accidental, or intentional—has been important to the ecology of our southern pine forests. Because it affects different plants in different ways, fire can have an important effect on the type of vegetation in a forest. In pine stands where fire has been excluded, low-quality, poorly adapted hardwoods often occupy much of the land and make it unsuitable for forestry, wildlife, or agricultural uses. Wildfires, of course, can devastate a stand. However, where periodic prescribed fires have been used in the management of pine stands, the forest floor is open and park-like, annual plants and low-growing sprouts are plentiful for wildlife food, and the stand is less susceptible to wildfire.

The total impact of different types of fire (wild and prescribed) on the forest environment is not well understood by many forest landowners or the general public. Consequently, many misconceptions on the use, value, necessity, and environmental impact of prescribed fire exist. This publication briefly explains prescribed fire, its uses, and the contrasting environmental effects of prescribed fire and wildfire.

## **Prescribed Fire**

Prescribed fire or prescribed burning is considered to be an indispensable and economical tool for managing much of the pine forest area in the South. Each year nearly three million acres are burned by prescription for an average cost, at current prices, of only \$3-5 per acre! Prescribed burning is conducted by foresters under carefully selected conditions, so that low intensity, controlled fires accomplish some clearly defined management objective.

Technical procedures in forestry, as in any profession, should be performed by individuals who have been properly trained. And prescribed burning is no exception. A knowledge of various weather factors that affect fire behavior and smoke dispersal are necessary, as well as an understanding of suppression procedures and environmental effects of fire. Several burning techniques may also be used depending on the management objective, weather, topography, and fuel conditions.

Of course, having a stand of trees that can tolerate the heat of a prescribed fire is necessary. Fortunately, once thickened, rough bark develops on the lower trunks of most southern pines, the trees are protected from the low-intensity flames of prescribed fires. Most pines 4 inches or larger at 4½ feet above the ground have bark thick enough to tolerate prescribed burning. As long as the needles are well above the height of the flames, the trees are not damaged. However, longleaf pines in the "grass stage" can also tolerate prescribed fires.



**A prescribed fire burning slowly through a pine stand.**

Traditionally, prescribed fire has been restricted to pine stands, since hardwoods have been considered more susceptible to damage from any type of fires. The main concern has been for increased wood rot problems that can occur following fire-caused trunk damage. However, even hardwoods may reach a size or have bark thick enough to tolerate low-intensity prescribed fires. More research is needed to help answer this question.

In pine stands, however, properly planned and executed prescribed burns can accomplish many management objectives at a very reasonable cost. Forests are an important and necessary part of our lives and well being. Only through proper management, however, will our forests be able to continue meeting the various forest resource requirements of our society. Prescribed fire is a practical, economical, safe, and necessary technique for accomplishing multiple-use objectives.

## **USES FOR PRESCRIBED FIRE**

### **Fuel Reduction**

The most common use of prescribed fire is fuel reduction. Forest fuels or "rough," such as grass, weeds, pine needles, and hardwood leaves, build up rapidly in pine stands and increase the potential threat of forest destruction by wildfire. Studies and experience have shown that wildfires occur less frequently, burn less intensively, and cause less damage where fuels have been reduced by prescribed burning. A USDA-Forest Service study on nearly one million acres in the southern coastal plain revealed that (1) the rate of wildfire occurrence increased as the age of the rough (amount of fuel accumulated) increased, (2) the acreages burned by wildfire increased dramatically as the age of the rough in-

creased, (3) the 12 large wildfires on the study area originated and burned mainly in the oldest rough and burned with greatly reduced intensity when they entered previously prescribed burned areas.

A burning rotation of about 3 years is usually adequate. However, the frequency of wildfire in the area, risk, and fuel accumulation, as well as the objectives of the landowner, will help determine burning intervals. The need for fuel reduction is becoming increasingly important as the acreage of pine plantations increases. Prescribed burning offers the most practical and economical means of accomplishing this objective.

#### **Understory Hardwood Control**

Hardwoods often encroach in stands being managed for pines because they can tolerate the shade conditions. Unwanted understory species compete for moisture and nutrients with the pines and interfere with regeneration. If not controlled, poor-quality hardwoods can lower the growth rate of the pine overstory and eventually take over the site. Prescribed burning does not eliminate understory hardwoods but controls their size to minimize competition. Periodic burns can effectively control hardwoods less than 3 inches in diameter at the ground line.



**Understory hardwoods killed by prescribed fire.**

#### **Site Preparation**

Pines cannot successfully regenerate or reproduce under shade of competing vegetation or on littered seedbeds. Prescribed fire can reduce the amount of litter to allow for direct seeding or natural regeneration. Burning an area before seeding or planting also reduces the effect of competing vegetation until the pine seedlings become established.

#### **Wildlife Habitat**

Fire may be prescribed specifically to improve wildlife habitat, but prescribed burns for other purposes benefit wildlife as well. Burning understory hardwoods promotes new, low sprout growth that is excellent deer browse. Fuel reduction burns create openings in stands for im-

proved feeding, traveling, and dusting. The increase in annual plants, seeds, and some insects following burning is especially beneficial to quail and turkey.



Low sprout growth following prescribed fire makes excellent deer browse.

### **Disease Control**

Prescribed fire may be used to control brownspot needle blight, a serious disease of longleaf pine seedlings. Burning is the only practical way to destroy the infected needles. The occurrence of annosus root rot also appears to be reduced in pine stands that are periodically burned by prescription.

### **Other Uses**

Where cattle are grazed on forested ranges, periodic prescribed burns increase the quantity and quality of the forage. Prescribed fire is also used to enhance the aesthetic appearance of stands and to improve accessibility before harvesting operations.

## **WILDFIRE**

Although extensive fire prevention and control programs have successfully reduced wildfire damage to forests, wildfire is still a serious problem. On the average nearly two million acres of protected forest land are burned by wildfire in the United States each year. Approximately one-half of this total, or one million acres, is burned in the thirteen southern states. During the last 5 years, South Carolina alone has had an annual average of over 30,000 acres burned by wildfires. In addition 54 percent of the area burned in the southern region was burned by maliciously and purposefully set wildfires (1975 statistics).

The chance of wildfire is increasing also. As our population grows, people are spending more leisure time in forests for recreation. Greater

use of forests and the growing value of forest products increase the hazard and potential losses from wildfire.

## **WILDFIRE VS PRESCRIBED FIRE—ENVIRONMENTAL EFFECTS**

### **Effect on Timber**

*Wildfire*—Wildfires usually occur during adverse weather conditions (especially drought) in areas where large amounts of forest fuels are present. Surface fires burn with high intensity and may develop into tree-top or crown fires. Merchantable timber may be killed outright by high-intensity wildfires. Although not all wildfires kill trees, a fire scar may be left (especially on hardwoods) where disease organisms can enter. Damaged trees may become unmerchantable or unsuitable for high-quality lumber or other products.

Wildfires, especially when repeated in one area, can change valuable forest stands into acres of unproductive, unwanted tree species. For instance, a stand of southern pine may become nothing more than a scrub oak wasteland after one or more wildfires. The cost of converting such an area to a productive pine forest can be very expensive.

*Prescribed fire*—Low-intensity prescribed fires, when properly used, remain as surface fires and do not damage large trees in pine stands. Prescribed fire also controls understory hardwoods to maintain economically the more timber-productive pine stands. But most importantly, forest fuels are reduced and thus minimizes potential losses from wildfire.

### **Effect on Water**

*Wildfire*—Improving water quality is of primary concern to everyone interested in our natural resources. Unfortunately, wildfires often hinder our ability to accomplish this goal. Wildfires usually burn with high intensity, consume all the ground litter layer, and expose bare soil. As a result, watersheds absorb less rainfall, and water runoff increases. If bare soil is exposed on slopes, the additional surface runoff will carry suspended soil particles and other materials into streams or adjacent bodies of water. Siltation and a general reduction in water quality result.

*Prescribed fire*—Unlike wildfire, a properly applied prescribed fire does not remove all of the ground litter and does not kill the roots of most understory plants. The remaining litter and plants protect the soil to help regulate runoff and control erosion.

### **Effect on Soil**

*Wildfire*—Intense wildfires have an indirect effect on forest soils, because they completely consume the litter layer of the forest floor and expose bare soil. Surface water and falling raindrops change the physical structure of exposed soils by moving soil particles. Fine particles clog soil pore spaces, so that surface runoff increases and the rate of water absorption in the soil decreases. On some soils and terrain erosion becomes a problem.



**Stand destroyed by wildfire. Soil erosion is becoming a problem.**

*Prescribed fire*—The physical and chemical properties of forest soils and long-term site productivity appear to be unchanged by prescribed fires. Any changes in soil pore space and infiltration rates are too small to detect where the organic layer is not completely consumed. Similarly, various studies have indicated that prescribed fire has no adverse effect on various insects, mites, and fungi of the forest floor. Although some insect populations are reduced immediately following a burn, population levels appear to return to or exceed pre-burn levels within short periods.

#### **Effect on Wildlife**

*Wildfire*—The destructive impact of large, rapidly moving wildfires on trapped animals and nesting birds requires no detailed description. Fire also destroys cover and forage plants. Ashes and exposed soil wash into streams. Fish and other water animals may be unable to survive in the silted water.

*Prescribed fire*—The advantages of prescribed fire for improving wildlife habitat have been indicated earlier. Cover and food conditions can be improved to favor various game species, especially quail, turkey, and deer. As prescribed fires are usually slow-moving and rather small in size, animals in the area to be burned are not trapped. In addition, prescribed fires are not used during nesting seasons.

#### **Effect on Air Quality**

*Wildfire*—Although several gases are given off by any fire in a forest, the highly visible smoke or particulates cause the most concern. Smoke consists of water, small aerosols or particles of organic material, and finely divided unburned carbon. Particulates or smoke create local hazards to air and surface transportation by reducing visibility. Since the smoke stays near the ground longer at night, night fires are especially hazardous to highway transportation. In addition, large sustained wildfires significantly contribute to the total air pollution of an area.

National estimates indicate that forest fires contribute only about 8 percent to the total air pollution problem, at the most. Although this is a

small amount, the technology exists to economically reduce that percentage of pollution and improve our air quality.

#### ENVIRONMENTAL EFFECTS OF FIRE

Effect on:	Prescribed Fire:	Wildfire:
Timber	No damage when properly used	Varies greatly, can destroy all trees
Water	No adverse effects when properly used	Can contribute to silting and reduce water quality
Soil	Litter layer not completely burned and soil not exposed	Bare soil often exposed, water runoff increases, erosion may become a problem
Wildlife	Improves cover and food conditions for some game species	Destroys animals, cover, and forage plants
Air	1/3 less smoke/ton of fuel than wildfire, only lasts a few hours, atmospheric conditions favor smoke dispersal	Smoke reduces visibility, creates local hazards to transportation, may last many days
Recreation	Improves accessibility for hunting and other recreation uses	May completely destroy forest for recreational uses

*Prescribed fire*—One of the biggest public concerns regarding the use of prescribed fire has been its effect on air quality. Ironically, prescribed fire provides one of the best and most economical means of reducing air pollution resulting from forest fires.

The potential for air pollutant release by prescribed fire is lower than for wildfire, since prescribed fire consumes less fuel. Furthermore, backing fires (the most common prescribed burning technique) produce about 35 percent less particulate matter than headfires. On the average nationwide, it is estimated that prescribed fires produce only 50 pounds of particulates for each ton of fuel consumed. The national average for wildfires is 150 pounds per ton of fuel consumed, and, as mentioned, a larger quantity of fuel is consumed.

Prescribed fires do not last for many days as wildfires often do. They ordinarily burn only a few hours during the day when atmospheric conditions favor good smoke dispersal. Smoke management guidelines are also available, and forest managers can identify smoke-sensitive areas (highways, residential areas, etc.). Burns can then be planned so that the smoke is carried away from these areas.

#### Effect on Aesthetics and Recreation

*Wildfire*—Wildfires destroy the beauty and desirability of forests for recreational use. Trees are blackened, plants are killed, streams may become undesirable for fishing, and the stand composition may be totally changed to scrubby undergrowth.

*Prescribed fire*—Prescribed fire controls the size of understory growth to improve accessibility for hunting or other recreational uses. It also helps maintain a variety of plants, including many flowering annuals.

## **Regulations and Assistance**

South Carolina, like most states, has various laws pertaining to forest fires. Those laws most applicable to prescribed fire mainly concern notifying the State Forester or his local representative before burning and establishing prior authorization from the landowner. The Department of Health and Environmental Control has recognized the value of prescribed fire. Its use for forest management is considered appropriate when acceptable practices are followed and no undesirable levels of pollutants are, or will be, created.

Prescribed fire information and assistance is available through the South Carolina State Commission of Forestry and consulting foresters. Additional information is available from county Extension offices or the Clemson University Extension Forestry office.

### **Summary**

Wildfires are a menace to forest lands, but low-intensity prescribed fires are beneficial and sometimes necessary to maintain certain types of southern forest stands. Prescribed fire has a number of valuable uses, but the most important is reducing potential damage to our forest resources and environment by wildfire.

The planning and use of prescribed fire requires trained, experienced personnel. However, landowners and the public can help promote good forest management by recognizing and understanding the value of prescribed fire as a management tool.

### **Suggested Reading**

For additional information, read "A Guide for Prescribed Fire in Southern Forests—1977," Southeastern Area, State and Private Forestry #2, USDA-Forest Service. You may get a copy from the Clemson University Extension forestry office.